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ADSORBING BODY FOR INSERTION INTO PACKAGE

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ADSORBING BODY FOR INSERTION INTO PACKAGE

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[Attached amendments have been incorporated into text of translation.]

Claims

1. A type of adsorbing body for insertion into a package, characterized by the fact that it is made from a molding of a mixture of polyolefin-based resin and an adsorbent finer than 60 mesh.
2. The adsorbing body for insertion into a package described in Claim 1, characterized by the fact that the amount of polyolefin-based resin is in the range of 90-30 parts by weight, and the amount of the adsorbent is in the range of 10-70 parts by weight.

3. A type of adsorbing body for insertion into a package, characterized by the fact that it is prepared by foam molding a mixture of polyolefin-based resin and an adsorbent finer than 60 mesh.

4. The adsorbing body for insertion into a package described in Claim 3, characterized by the fact that the amount of polyolefin-based resin is in the range of 90-30 parts by weight, and the amount of the adsorbent is in the range of 10-70 parts by weight.

#### Detailed explanation of the invention

##### Industrial application field

This invention pertains to a type of moisture-absorptive and/or deodorizing adsorbing body for insertion into a sealed container, sealed bag, or other sealed package. More specifically, this invention pertains to a type of adsorbing body for insertion into a package characterized by the fact that it is a polyolefin-based resin molding treated to have moisture absorptivity and/or deodorant properties, and it is mainly used by insertion into automatically packed packages to maintain the contents in dry and/or deodorized state.

##### Prior art

In order to maintain the space in package containers for high-precision equipment, medicine, food, etc., dry for a long time, or to eliminate offensive odors, bags filled with silica gel, activated carbon or other adsorbents are used. These bags are sealed in the package containers at the same time that the containers are sealed. The bags connected to each other are cut and inserted into the packages in the automatic filling and packaging operation, or the bags may be separated and arranged in a row, so that they are dropped one by one into the packages by an automatic packaging device. However, in these methods, there are problems in the adsorbent bag-filling operation.

##### Problems to be solved by the invention

That is, when silica gel or other desiccant is filled into a bag, as the particles are electrostatically charged, they cannot get to the bottom of the bag. Instead, the particles float midway in the bag. Consequently, bags with insufficient desiccant or bags with defective cutting between them occur frequently. Also, when the bags are automatically inserted into containers in the packaging operation, it is impossible to divide the various bags from each other by cutting correctly in the center of the sealing portion between desiccant bags. Instead, the bag main body may be cut, so that the desiccant flies out when the bags are automatically loaded. As a result, the obtained packages become defective. Also, as the desiccant is a powdery substance, when it

is inserted into bags, unevenness results with respect to the shape, in particular, unevenness in thickness, shifting of the filled portion, etc.

Consequently, when packaging for high-precision equipment, cameras, medicine, food, etc., is performed in the prior art, insertion of the desiccant bags becomes a factor that hampers smooth operation in the automatic packaging. In addition, as far as the desiccant requirements for packages are concerned, of course, water absorptive capacity and water absorptivity should be high. Also, the water absorption speed should be appropriate. However, there is no way to adjust the water absorption speed.

Japanese Kokoku Patent No. Sho 56[1981]-41409 disclosed a type of plastic film for packaging prepared by adding silica gel or another fine desiccant powder. However, in this method, for the sheet containing desiccant itself, it is necessary to maintain the performance of the function as a packaging film. Consequently, there is a limit to the amount of desiccant contained in it and to the thickness of the film, and it is impossible to form it with a sufficient amount of desiccant added in it so that the desiccant function can be effectively exhibited. Also, in this method, transparency of the packaging film degrades. This is undesired.

#### Means to solve the problems and operation

According to this invention, in order to eliminate the bag-filling operation, an adsorbent is added to a polyolefin-based resin, and the mixture is formed into a sheet shape or foam molded so that the adsorbent is not filled in a bag and the contents in packages are not contaminated. Also, as said sheet is inserted into packages, there is much freedom with respect to thickness and amount of adsorbent added, and it is possible to exhibit the adsorbent functions effectively.

Examples of the polyolefin-based resins as forming material for the adsorbent include high-density polyethylene, low-density polyethylene, linear low-density polyethylene, polypropylene, ethylene-vinyl ester copolymer, ethylene-(meth)acrylate copolymer, ethylene-(meth)acrylate and other ethylene- $\alpha,\beta$ -unsaturated carboxylate copolymers, low-crystalline and noncrystalline ethylene-propylene copolymer and other ethylene- $\alpha$ -olefin copolymers, etc. They may be used either alone or as a mixture of several types. Also, it is possible to add natural rubber, soft polyvinyl chloride, polystyrene, or other polymeric substances into said polyolefin-based resin.

The adsorbing body of this invention may be prepared by extrusion molding of a mixture of polyolefin-based resin and adsorbent as is. However, foam molding is even better as it can significantly increase the surface area of the adsorbing body and can exhibit the effect of the added adsorbent, and it can increase the content of adsorbent and the thickness of the adsorbing body. Manufacturing of the foam molding may be carried out by foaming a homogeneous

mixture of polyolefin-based resin and adsorbent in the presence of propane, freon, azo-dicarbonamide, or other volatile or pyrolytic blowing agent to enlarge it about 1.2-25 times.

The foam molding made from a polyolefin-based resin is usually a foam having independent bubbles. However, it is also possible to obtain a foam with continuous bubbles by adding styrene-butadiene copolymer rubber or another synthetic rubber for foaming. For the foam with continuous bubbles, the moisture adsorption rate is higher than that of the foam having independent bubbles. Consequently, it is possible to exploit this characteristic feature to adjust the mixing ratio of a polyolefin-based resin and synthetic rubber so as to adjust the moisture adsorptive rate.

Examples of the adsorbents that may be used in this invention include silica gel, active alumina, acidic white clay, active white clay, zeolite, and other desiccating substances, as effectively as activated carbon, zeolite and other deodorant substances. For these adsorbents, if the particle size is too large, the mixing property with polyolefin-based resin is poor, the contents of packages may be contaminated, and the adsorption function cannot be effectively exhibited. Consequently, it is preferred that the particles be fine, with a particle size of 60 mesh or finer.

As far as the proportion of the adsorbent is concerned, the amount of polyolefin-based resin should be in the range of 90-30 parts by weight, or preferably in the range of 80-50 parts by weight, and the amount of the adsorbent should be in the range of 10-70 parts by weight, or preferably in the range of 20-50 parts by weight. If the proportion of the adsorbent is less than the aforementioned range, the adsorbing power is insufficient, and the purpose of this invention cannot be realized. On the other hand, if it is above the aforementioned range, the adsorbing body is prone to damages so that contents of the package became contaminated.

The thickness of the adsorbing body should be in the range of 1.3-5 mm, or preferably in the range of 1.5-3 mm. The adsorbing body is cut to an appropriate shape in an appropriate size that fits the shape of the container, and it is inserted into the container at the same time that the container is sealed.

#### Effect

The adsorbing body of this invention has a shape not limited to granules and films. Instead, it can have any shape that is formed as desired. Consequently, it can have a shape fitting the package container of the commodity or the automatic packaging operation. As the adsorbent can be buried inside the resin layer, there is no shedding of powder, and the water absorption rate can be adjusted. Also, as it has a sheet shape, accidents from ingestion can be avoided. In addition, it is possible to avoid the various problems in the prior art, such as poor filling of the bags due to the electrical charge between the adsorbent and bags in the bag-filling operation,

insufficient amount of connected bags filled with adsorbent, scattering of adsorbent due to incorrect cutting position, etc.

#### Application Example 1

35 parts by weight of silica gel (passing 60-mesh sieve, with an average particle size of 150  $\mu\text{m}$ ) were mixed with 65 parts by weight of low-density polyethylene. Using a conventional method, blending and extrusion were performed for the mixture to form an adsorbing body with 2.5 mm thick and containing 800 g/m<sup>2</sup> silica gel. ✓

Two pieces of said adsorbing body measuring 10 cm x 22 cm were inserted together with 100 g of commercially available cookies into a bag (10 cm x 25 cm) made of a laminated film composed of a 22- $\mu\text{m}$ -thick drawn polypropylene film and a 20- $\mu\text{m}$ -thick polyethylene film. The bag was stored at 25°C and 80% RH, and variation in the water content (%) of the cookie over time was measured and listed as (A) in Table 1. Variation in aroma of the cookie is listed as (A) in Table 2.

As comparative examples, 35 g of silica gel in place of the adsorbent of this invention were used to prepare sample (B), and cookie alone was packed to prepare sample (C). The results for those controls are also listed in Tables 1 and 2.

Table 1

Time (days)	Type of cookie package		
	A	B	C
0	3.9%	3.9%	3.9%
1 week	4.0%	3.9%	6.0%
2 weeks	4.1%	3.9%	7.8%
3 weeks	4.1%	3.9%	8.9%
4 weeks	4.1%	4.0%	9.8%
5 weeks	4.2%	4.0%	10.2%
6 weeks	4.2%	4.1%	10.7%
7 weeks	4.2%	4.1%	11%
8 weeks	4.2%	4.2%	11%

Table 2. Variation in aroma (with a 5-point rating system)

Time (days)	Type of cookie package		
	A	B	C
0	5	5	5
1 week	5	5	4
2 weeks	5	5	4
3 weeks	5	5	3
4 weeks	5	5	3
5 weeks	5	5	2
6 weeks	5	5	2
7 weeks	5	5	2
8 weeks	5	5	2

For cookies, it is preferred that the moisture content be 4% or lower. If the moisture content is over 8%, the taste drastically degrades, and the commercial value is lost.

#### Application Example 2

30 parts by weight of activated carbon (passing a 60-mesh sieve, with an average particle size of 120  $\mu\text{m}$ ) were mixed with 70 parts by weight of low-density polyethylene, and the mixture was used to form a delayed-action long-lasting functional adsorbent 2.5 mm thick and having a deodorant effect.

In order to deodorize the interior of a bottle for a sports drink and manufactured by blow molding (volume of 1 L, main body made of polyethylene, cap made of polypropylene), a piece of adsorbent measuring 3 cm x 20 cm was sealed in the bottle. The equivalent amount of activated carbon in the adsorbent is 3.3 g. The bottle was stored at 25°C and 80% RH. It was found that while an odor was sensed immediately after sealing, the odor decreased after 4 weeks, and entirely disappeared after 8 weeks.

On the other hand, for the control, a bag containing 2 g of activated carbon was sealed in said bottle. It was found that the odor decreased after about the 10<sup>th</sup> day. For a bottle without any adsorbent sealed in it, the same odor lasted from immediately after sealing to 8 weeks and later.